Preservice and Inservice Teachers' Implicit Theories of Intelligence

By Brett D. Jones, Lauren H. Bryant, Jennifer Dee Snyder, & David Malone

Brett D. Jones is an associate professor in the Department of Learning Sciences and Technologies and Lauren H. Bryant and Jennifer Dee Snyder are doctoral students in the Educational Psychology Program, all with the School of Education at Virginia Tech, Blacksburg, Virginia. David Malone is an associate professor in the Program in Education and director of the Service Learning Program at Duke University, Durham, North Carolina.

Implicit theories of intelligence (i.e., individuals' beliefs about the nature of intelligence, such as whether it is fixed or changeable) are important because they are related to individuals' behaviors and their beliefs in other areas (Sternberg, 2000). Implicit theories of intelligence are especially important in educational settings because students who view intelligence as something that can be changed tend to be more academically motivated and perform at higher academic levels than students who view intelligence as a fixed, unchangeable trait (Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 1999). Thus, researchers have found it useful to think about implicit beliefs of intelligence as being in one of two categories: the incremental view of intelligence or the entity view of intelligence (Dweck, 1999; Hong, Chiu, Dweck, Lin, & Wan, 1999). An incremental view is defined as the belief that individuals have some level of control over their own intelligence, and that their intelligence level can be increased through studying and learning. In contrast, those with an entity view of intelligence

believe that humans are born with a level of intelligence that is pre-determined by genetics, and that this level of intelligence is static.

Much of the research related to implicit theories of intelligence has focused on investigating the beliefs of students. As a result, there is less research related to *teachers'* beliefs about intelligence. Teachers' conceptions of intelligence are important, however, because they have been found to affect students' beliefs about intelligence (Oakes, Wells, Jones, & Datnow, 1997; Watanabe, 2006), which in turn impacts students' motivation and achievement (Dweck, 1999). The purpose of this study is to contribute to the literature on implicit theories of intelligence by investigating the nature of preservice and inservice teachers' intelligence beliefs.

Background

Students' Implicit Theories of Intelligence

Some evidence indicates that children's beliefs about the stability of intelligence change as they get older. Younger children are more likely to believe that intelligence is changeable until about the age of 10-12 years old, when they begin to develop more entity-like theories of intelligence (Dweck, 1999; Dweck & Elliott, 1983). However, the extent of the change in children's beliefs from incremental to entity is not well understood. In one study, 87% of kindergarteners, 90% of second graders, 97% of fifth graders, and 88% of eighth graders responded that they could change to get smarter (Kurtz-Costes, McCall, Kinlaw, Wiesen, & Joyner, 2005), indicating that most of them held a changeable view of intelligence. Similarly, Jones, Byrd, and Lusk (2009) found that 88% of ninth- and eleventh-grade students reported believing that intelligence was malleable. These findings suggest that the percentage of students who believe that intelligence is malleable remains high and fairly consistent from kindergarten through eleventh grade.

Some researchers have explicated the relationship between implicit theories of intelligence and students' achievement and motivation. In general, an incremental view of intelligence has been linked to higher student achievement (Blackwell et al., 2007; Dweck, 1999; Gonida, Kiosseoglou, & Leondari, 2006; Henderson & Dweck, 1990; Roedel & Schraw, 1995). Some researchers have documented that an incremental view is directly related to achievement (Gonida et al., 2006), whereas others have found this link to be indirect, mediated by learning goals (Roedel & Schraw, 1995; Leondari & Gialamas, 2002). Other researchers have tested a more complex model in which an incremental theory of intelligence led to mastery goals (a.k.a., learning goals) and positive effort beliefs, which then led to fewer ability-based, helpless attributions and more positive strategies, which led to improved grades (Blackwell et al., 2007; Jones, Wilkins, Long, & Wang, 2011).

An incremental view of intelligence has also been linked to an increase in factors related to students' motivation. Students with an incremental view are more likely than those with an entity view to devote more effort to a learning task, to try again after

failure (Hong et al., 1999), to be more diligent in their work, to demonstrate more concentration (Ommundsen, Haugen, & Lund, 2005), and to use study strategies that are more effective and require more effort (Jones, Slate, Marini, & DeWater, 1993). In contrast, learners with an entity view of intelligence are more likely to give up on a task when faced with adversity (Zuckerman, Gagne, & Nafshi, 2001).

Teachers' Implicit Theories of Intelligence

Given the positive academic behaviors and significant learning outcomes related to students' implicit theories of intelligence, it is important to consider how students' implicit theories are formed and developed. Because teachers work closely with students during their academic learning, it is reasonable to suspect that teachers could influence students' implicit theories of intelligence. In this section, we discuss teachers' implicit theories of intelligence and their impacts on students.

Researchers have documented significant relationships between teachers' implicit views of intelligence and the behaviors that they value in students (Lynott & Woolfolk, 1994). Teachers with more incremental views of intelligence were more likely to value practical skills (e.g., developing technical knowledge and mastering basic skills) and social behaviors (e.g., fostering cooperation) as indicators of intelligence than teachers with entity views. Links have also been found between teachers' implicit views of intelligence, the educational goals that they set (Lynott & Woolfolk, 1994), and their approach to teaching (Leroy, Bressoux, Sarrazin, & Trouillod, 2007; Southerland & Gess-Newsome, 1999). Leroy et al. (2007) surveyed 336 French fifth-grade teachers using measures of self-efficacy, implicit theories of intelligence, perceived work pressures, and support of autonomy in the classroom. They reported that teachers with a fixed view of intelligence were less likely to create the types of autonomy-supportive climates in their classrooms that can promote students' intrinsic motivation. Teachers with incremental views of intelligence were more likely to have higher self-efficacy, which has been linked to improvements in teacher effectiveness (Leroy et al., 2007).

Other researchers have reported that teachers' judgments of their students' intelligence can impact the students' views of intelligence (Pretzlik, Olsson, Nabuco, & Cruz, 2003). In a study of Year 5 and 6 teachers in the United Kingdom (similar to fifth and sixth grade in the U.S.), Pretzlik et al. (2003) found that teachers' judgments of pupils' intelligence influenced not only the students' perspectives of their own intelligence, but also judgments of their peers' intelligence. When the study was replicated with Kindergarten teachers in Portugal, similar results were obtained. In addition, the results indicated that the majority of teachers had views of intelligence that reflected what would typically be measured by an IQ test. These results suggest that teachers' implicit theories of intelligence might unintentionally influence the beliefs that their students have about intelligence.

Another important issue to consider is how teachers' implicit theories of intelligence might change over time. In a study of novice and experienced teach-

ers, Georgiou (2008) found that experienced teachers were more likely to believe that biological factors that were uncontrollable by the child were determinants of students' abilities. Such factors included gender and genetic predisposition. Experienced teachers were also more likely to believe that students' abilities were fixed and uncontrollable by the student. Georgiou (2008) hypothesized that the difference between novice and experienced teachers' beliefs was the result of a "disillusionment process" whereby novice teachers' unrealistic expectations eventually gave way to the realization that they do not have complete control of students' learning. As teachers become more experienced, they might begin to believe that gender and other fixed factors are determinants of achievement, which may impact their behavior in the classroom and create self-fulfilling prophecies. In these cases, teachers' expectations might produce changes in students that are consistent with the teachers' expectations (Rosenthal & Jacobson, 1968).

Rationale and Research Questions

The rationale for our study is based on several gaps in the literature related to teachers' implicit theories of intelligence. Although some researchers have examined students' (and to a lesser extent teachers') implicit theories of intelligence, few have investigated *preservice* teachers' theories of intelligence. Georgiou (2008) documented differences between novice and experienced teachers' beliefs; however, it is unknown how these beliefs might extend to preservice teachers. Further, Georgiou's study was conducted in one European country; thus, examining preservice teachers' beliefs in other countries would provide evidence as to whether the trends discovered in that study generalize to other countries and cultures. The purpose of this study was to investigate the following research questions. First, how do preservice and inservice teachers define intelligence? Second, do preservice and inservice teachers view intelligence primarily as a malleable or fixed entity?

Method

Participants

A convenience sample of students from two large public universities and one large private university were asked to participate in the study. At the beginning of the semester, students were asked by their instructors to participate in the study by completing a questionnaire during class time. All of the 270 students in all 10 course sections at all three universities agreed to participate, which resulted in a 100% response rate. Students who were absent during the first questionnaire administration completed it the next time that they attended class. Most of the students were female (80.0%) and White/Caucasian (81.9%), whereas 8.9% were Black or African-American, 3.7% were Hispanic, 1.9% were Asian or Pacific Islander, 0.4% were American Indian, 1.9% were of another race, and 1.5% did not provide a response.

The number of courses and participants for each university is presented in Table

1. All six of the courses included topics related to educational psychology (e.g., learning, development) and were offered through an education program, school, or college. The undergraduate courses were considered "upper-level" courses and most of the students were juniors or seniors. Given our extensive knowledge of these courses and the students who typically enroll in them, we suspect that most students planned to teach in the future. However, we did not track students to determine how many students actually chose a teaching position upon graduation.

We separated the students who had at least one year of full-time teaching experience (whom we labeled "inservice teachers") from the preservice teachers because teaching experiences can have an influence on teachers' beliefs about intelligence (Georgiou, 2008). The average age of the 33 inservice teachers was 35.8 (*SD*=9.5) and the number of years that they had taught in the PreK-12 setting ranged from one to 31 years (*M*=9.0; *SD*=8.3), with 14 having taught one to five years, 11 having taught six to 10 years, three having taught 11 to 15 years, and five having taught more than 15 years.

Procedure and Measures

We employed a concurrent, mixed method approach wherein qualitative and quantitative data were collected simultaneously. The collection of qualitative data was necessary to gain a richer understanding of students' conceptions of intelligence. The use of quantitative data was necessary to determine whether students tended to view intelligence as a fixed or malleable entity.

At the beginning of one of the first classes of the semester, the course instructor described the study, asked students to participate, and told them that their grade in the course would not be affected by their participation in the study. Participants voluntarily completed a questionnaire that required approximately 10-15 minutes to complete. In addition to their demographic information, students were queried about their beliefs about intelligence with two measures: a *Definition of Intelligence* item (Jones et al., 2009) and the *Theories of Intelligence Scale–Self Form for Adults* (TIS; Dweck, 1999).

To assess students' definitions of intelligence, we used an open-ended item from Jones et al. (2009), titled *Definition of Intelligence*. The item read:

Table 1

Number of Courses and Participants

	No. of courses	No. of course sections	Preservice teachers		Inservice teachers	
			Undergr.	Graduate	Undergr.	Graduate
Public university 1	3	6	91	23	12	20
Public university 2	1	1	47	14	0	0
Private university	2	3	62	0	1	0

> Imagine that you believe your friend Janice is more intelligent than your friend Amy. Based on <u>your</u> beliefs, what characteristics does Janice have that make her more intelligent than Amy? In other words, what would make you think that one person is more intelligent than another? *(Please write at least a few sentences to explain your answer.)*

To classify students as having either a malleable or fixed view of intelligence, we used a quantitative measure titled the *Theories of Intelligence Scale–Self Form for Adults* (TIS; Dweck, 1999). The short form of this scale consists of three items with a Likert-format scale ranging from 1 to 6 (1=*Strongly Disagree*; 2=*Disagree*; 3=*Mostly Disagree*; 4=*Mostly Agree*; 5=*Agree*; and 6=*Strongly Agree*). The three item included: "You have a certain amount of intelligence, and you really can't do much to change it"; "Your intelligence is something about you that you can't change very much"; and "You can learn new things, but you can't really change your basic intelligence." The three items were averaged to form a theory of intelligence score. Researchers have evaluated the psychometric properties of the scale empirically and have reported strong factorial validity and reliability of scores (e.g., Dweck, Chiu, & Hong, 1995; Levy, Stroessner, & Dweck, 1998). The Cronbach's alpha for the data in the present study was excellent (α=.92).

Analysis

For the open-ended *Definition of Intelligence* item, we used a thematic whole text analysis, that was informed by the analytic procedure developed by Glaser and Strauss (1967; also see Strauss & Corbin, 1998) to develop a grounded theory. The first author of this article developed the initial coding scheme for the item responses after reading all of the responses, identifying seven themes, and creating 55 coding categories within the themes. Next, three of the authors independently coded 27 (10%) of the responses and compared their codes. After coding the responses, the three authors re-analyzed the coding categories and re-read the responses within each category to ensure that none of them were redundant or overlapped in function. As a result of this re-analysis, we eliminated or re-categorized 13 of the 55 original coding categories, which resulted in a total of 42 final coding categories. After we finalized the themes and categories within the themes, we compared them to the theme content and titles used by Jones et al. (2009) in their similar analysis. Where appropriate, we used similar, or the same, titles. The inter-rater reliability rate after the re-categorization was 86.7%.

Results

Definition of Intelligence

Our analysis of the responses to the open-ended *Definition of Intelligence* item yielded seven themes and 42 categories (see Table 2). In Theme 1, *Achievement*, an intelligent person was defined as one who achieves highly in school or in a career.

Table 2
Reasons One Person is More Intelligent Than Another

Type of Response	% of college students with no teaching experience (n=237)	% of college students with teaching experience (n=33)
Theme 1: Achievement		
Is a higher achiever in school	22	9
Has a job that requires more intelligence	2	3
Theme 2: Declarative Knowledge		
Has knowledge of a variety of subjects	24	24
Has in-depth knowledge of one subject	24	9
Has a large vocabulary	12	18
Has a knowledge of current events	9	6
Theme 3: Procedural Skills		
Has better social skills/emotional intelligence	30	18
Speaks well	23	36
Writes well	5	9
Listens well	4	6
Has good grammar	2	6
Has better physical skills	1	0
Theme 4: Self-Regulation		
Is more metacognitive or self-aware	7	18
Has self-control	3	0
Has academic self-discipline	3	0
Has better organizational skills	2	3
Theme 5: Cognitive Processes		
Has more common sense	25	9
Has more general cognitive ability	22	18
Makes good decisions	19	30
Is better at higher-order thinking and reasoning	17	18
Has a better memory	16	15
Is a good problem solver	16	15
Can apply theory to real life	11	9
Can adapt quickly	6	3
Can think for himself or herself	5	3
Is more creative	4	9
Has fixed, innate abilities	4	0
Can solve problems in his/her head	2	3
Can concentrate or focus	2	0
Theme 6: Motivation		
Is more enthusiastic about learning, inquisitive	11	27
Enjoys reading/reads a lot	6	18
Is more motivated in general	4	0
Enjoys his/her occupation more	1	3
Theme 7: Personal Characteristics		
Is more open-minded to new ideas and possibilities	16	24
Shows respect for people and their beliefs	5	3
Had a positive upbringing	3	3
Is well-rounded	3	3
Has a better sense of humor	2	12
Is not boastful	2	6
Presents herself or himself well	2	6
Can accept constructive criticism	1	6
Cares about others and the world	1	3

Within this theme respondents expressed that an intelligent person (i.e., Janice) would get better grades and score higher on exams. An intelligent person would also go on to obtain higher degrees, and eventually, work at a job that required more intelligence or provided a higher salary.

In Theme 2, *Declarative Knowledge*, an intelligent person was defined as one who possessed in-depth factual knowledge in one subject or a breath of factual knowledge across subjects. Some responses emphasized the importance of a general level of knowledge or having knowledge in many different areas. Many responses in this category acknowledged that levels of knowledge in these different areas would likely be uneven: an individual could have surface knowledge of one topic and complex knowledge of another. Some participants noted that Janice would be more intelligent if she were judged on her general level of overall knowledge in all subjects. Other participants stressed that Janice would possess an expert level of knowledge in one area, or would have one form of intelligence, similar to one of what Howard Gardner (1983) has labeled "multiple intelligences." Some respondents believed that a more intelligent individual would possess and use a large vocabulary and/or would have more awareness of current events.

For Theme 3, *Procedural Skills*, an intelligent person was defined as one who possessed skills. Some participants discussed the idea that Janice would have social skills and emotional intelligence. These skills included the ability to build relationships, be diplomatic, hold a good conversation, and have awareness of others' emotional states. One response in particular illustrates this point: "Janice may exhibit intuitive knowledge about people, she may be able to interact and communicate more effectively, and she may exhibit more socially acceptable behavior than Amy." This response suggests that an intelligent individual can function well in social situations and is someone whom others are comfortable being around. Speaking, writing, and listening skills were also included in this theme, as well as the ability to use proper grammar. One respondent also noted that he would view Janice as more intelligent if she had more physical skills, such as dance or sports.

In Theme 4, *Self-Regulation,* an intelligent person was defined as intelligent if he or she had a higher level of self-discipline and/or metacognition. Some participants focused on Janice's self-awareness, making statements such as, "Janice is more aware of her thoughts and how she processes them." Other responses in this theme included the importance of self-control, academic self-discipline, and good organizational skills.

In Theme 5, *Cognitive Processes*, an intelligent person was defined as one who had higher levels of thinking and/or learning capacities. Some participants noted that Janice could think for herself and make better decisions than Amy, whether these decisions were in the realm of academics or life in general: "She makes life decisions that better her." Participants also stated that Janice was more intelligent because she could learn new things quicker than Amy or had a better memory. Janice would also be able to generate solutions to different kinds of problems or

manipulate math problems in her head. She could adapt quickly and be more creative. Other participants focused on Janice's ability to apply what she learned in one context to the real world. Some participants discussed Janice's inherent ability, or the intelligence that she was born with or had received genetically.

In Theme 6, *Motivation,* an intelligent person was defined as one who had higher levels of general motivation and/or had an inquisitive nature. Responses in this theme described an intelligent person as someone who had a "thirst" for knowledge and made attempts at self-improvement. Some participants noted that Janice was an avid reader and enjoyed her occupation.

In Theme 7, *Personal Characteristics*, an intelligent person was defined as someone who had certain personality traits. The largest number of responses in this theme emphasized open-mindedness, especially to viewpoints that differed from the individual's personal viewpoints. Responses in this category also included Janice's ability to appreciate the pros and cons of opposing viewpoints and "see the whole." Other respondents noted that Janice was more intelligent because she had humility regarding her abilities and showed respect for other people. Some participants said that Janice had a positive upbringing, which included factors such as a nurturing environment as a child, having parents that valued learning, and having other positive role models such as teachers.

Malleability of Intelligence

We averaged the three items comprising the TIS to calculate a mean theory of intelligence score with the low end (1) representing a pure incremental (malleable) theory and the high end (6) representing a pure entity theory. The mean score on the TIS was 2.54 (SD=1.07) for the preservice teachers and 2.73 (SD=1.30) for the inservice teachers. Because there was no statistical difference between the means of the preservice and inservice teachers on the TIS (t[265]=0.93, p=0.36), we combined the scores on the TIS for these two groups and calculated that 77.9% reported an incremental view of intelligence (their mean scale score was less than 3.5). To investigate whether students with more teaching experience were more likely to have entity views (as reported by Georgiou, 2008), we correlated the TIS scores with the number of years of teaching experience for the 33 students who reported that they had completed at least one year of full-time teaching experience. We calculated that there was no statistical relationship between students' implicit beliefs of intelligence and years of teaching experience, r=0.15, p=0.42.

Discussion

Research Question 1: How is Intelligence Defined?

To address our first research question (i.e., How do preservice and inservice teachers define intelligence?), we examined the results of the *Definition of Intelligence* item and found that participants defined intelligence as including high

achievement in school, declarative knowledge, procedural skills, self-regulation, cognitive processes, motivation, and personal characteristics. The responses of the preservice and inservice teachers were similar in that we did not identify any major discrepancies between them. However, the primary purpose of this study was not to compare preservice and inservice teachers; otherwise, we would have included more than 33 inservice teachers in our study. As a result, we believe that this finding should be interpreted cautiously and that more research needs to be conducted to better understand how preservice teachers might differ from inservice teachers with respect to their definitions of intelligence.

We found it interesting that students' definitions of intelligence aligned very closely with current conceptions of knowledge structures that include declarative knowledge, procedural knowledge, and self-regulatory knowledge (Schraw, 2005). Because we did not intend to compare students' definitions of intelligence with current knowledge structure taxonomies at the beginning of the study, we did not include a research question related to knowledge taxonomies. But given the results, we found that the similarities were worthy of discussion.

The similarites between our codes and knowledge taxonomies is not unexpected given that the codes were developed by us, and as educational psychologists, we are aware of these categories of knowledge. However, the participants also recognized some of these categories as aspects of intelligence. The taxonomy of knowledge summarized by Schraw (2005) includes the following types of knowledge (the themes from Table 2 that correspond to each type of knowledge are included in parentheses): Declarative knowledge, consisting of Semantic (Theme 2) and Episodic; Procedural knowledge, consisting of Scripts (Theme 3) and Algorithms/heuristics (Theme 5); and Self-regulatory knowledge, consisting of Domain specific (Theme 2) and Domain general (Theme 4).

Themes 2, 3, 4, and 5 correspond closely with the types and subtypes of knowledge in Schraw's taxonomy. Theme 2, Declarative Knowledge, is the same as Schraw's semantic knowledge because they both include facts and concepts. Because the categories in Theme 2 also include in-depth knowledge in some areas, there is likely overlap with the self-regulatory domain-specific knowledge theme. Theme 3, Procedural Skills, is similar to Schraw's procedural knowledge scripts because they both refer to how to do things, such as speaking and writing. Theme 4, Self-Regulation, aligns well with Schraw's domain-general, self-regulatory knowledge that includes metacognitive knowledge and refers to how we regulate our memory, thoughts, and learning. Theme 5, Cognitive Processes, includes some categories that can fit into Schraw's algorithms and heuristics, such as "Is a good problem solver" and "Is better at higher-order thinking and reasoning." In sum, participants cited all aspects of Schraw's knowledge taxonomy except episodic knowledge. This finding indicates that knowledge is viewed as important to intelligence. In the other themes, they cited other things besides knowledge that are important to intelligence (i.e., achievement, motivation, and personal

characteristics), but certainly knowledge structures were key components to their conceptions of intelligence.

To provide a point of comparison for the results from this study, it is interesting to compare the results of the *Definition of Intelligence* item to the findings in the Jones et al. (2009) study because Jones et al. used the same item that we used in the present study, but their participants were high school students. Jones et al. identified five themes based on high school students' responses to this item, all of which are represented in the present study. The following themes were reported in Jones et al. and the themes in parentheses represent the corresponding theme titles from the present study: (1) Knowledge, Skills and Abilities (Declarative Knowledge, and to a lesser extent, Procedural Skills); (2) Academic Effort (Motivation); (3) Achievement (Achievement); (4) Decision Making (Self-Regulation); and (5) Personal Characteristics (Personal Characteristics). One difference between the two studies is that the Jones et al. study did not include a Cognitive Processes theme, which indicates that the college students in the present study were more likely to view concepts such as concentration, memory, adaptation, and creativity as important aspects of intelligence than were high school students. Another difference between these two studies is that the participants' responses in the present study were more nuanced and elaborate than the responses of the high school students. Possible reasons for this finding are that, compared to the high school students, the college students had more life experiences from which to draw upon because they were older and more educated.

Research Question 2: Is Intelligence Malleable?

To answer our research question as to whether preservice and inservice teachers viewed intelligence primarily as a malleable or fixed entity, we examined the results of the TIS scores. About three-quarters (77.9%) of preservice and inservice teachers viewed intelligence as incremental. This percentage is a little less than, but similar to, percentages reported in other studies for students in other age groups. Kurtz-Costes et al. (2005) reported that for U.S. students, 87% of kindergarteners, 90% of second graders, 97% of fifth graders, and 88% of eighth graders responded that they could changed to get smarter; thus, reflecting a malleable view of intelligence. Because this study used a different measure of perceptions of malleability, it is difficult to make direct comparisons to the results in the present study. Jones et al. (2009), however, used the same items that were used in the present study with high school students and they categorized 65.3% of students in one sample and 68.8% of students in another sample as having an incremental intelligence.

Comparing the present results to these other studies, the college students in the present study reported more malleable views than high school students, but less malleable views than the elementary and middle school students. The students in the Jones et al. (2009) study and the Kurtz-Costes et al. (2005) study differ from the college students in the present study in their ages and education levels. In addi-

tion, many students in the present study had already selected a career in teaching, whereas there was likely a broader range of background interests for the students in the other studies. We speculate that individuals who consider a career in teaching might be more likely to believe that "anyone can learn;" and thus, be more likely to hold an incremental view of learning than the average high school student.

Unlike teachers in the Georgiou (2008) study, teachers in the present study with more experience were not more likely than those with less experience to report an entity view of intelligence. More research in this area is needed, however, because we had only 33 students in the present study with at least one year of full-time teaching experience. Further, about half of the inservice teachers in the present study had six years of teaching experience or less. With a sample that included teachers with more teaching experience, it would be possible to compare the teachers with more experience to those with less experience. In addition, the inservice teachers in the present study were enrolled in college-level education courses, which might have affected their views of intelligence. Thus, our findings related to experienced teachers should be interpreted cautiously.

Implications and Future Studies

One implication of this study is that teacher educators need to examine how they convey beliefs about intelligence to their preservice teachers. About a quarter of the preservice and inservice teachers in this study believed that intelligence was fixed. This is problematic because Dweck's (2006) research indicates that individuals who believe that intelligence is innate and fixed frequently underestimate the importance of effort, which is important to students' academic success. Because Dweck noted that one characteristic that effective teachers bring to the classroom is a growth mindset (as opposed to a fixed mindset), teacher educators need to think about whether they are promoting a growth or fixed mindset with the students in their preservice teacher education courses.

Future studies should examine what and how teacher educators teach their preservice teachers about a growth or fixed mindset. It is likely that teacher educators convey mindsets verbally (through class lectures and discussions), as well as through course materials such as textbooks. In an analysis of how intelligence theories were presented in 11 popular educational psychology textbooks, Lusk and Jones (2011) documented that textbook authors' definitions of intelligence did not explicitly state whether intelligence was malleable or fixed. They also noted that textbook authors might send messages to readers about the malleability of intelligence by the types of theories included in the textbook and the amount of text devoted to each. Future studies could examine how instructional materials in other preservice teacher courses (e.g., methods courses) represent the malleability of intelligence.

At both the state and national levels, policymakers have been very concerned with identifying teachers who have the greatest impact on student achievement. Many

states have begun implementing value-added models of evaluating teacher effectiveness (Rotherham, 2010; Sanders & Horn, 1998). Value-added approaches use statistical regression models to determine which teachers in a particular school at a particular grade level have produced the greatest achievement gains among their students. However, value added models only identify effective teachers; they do not clearly identify the key characteristics of effective teachers, nor do they delineate how to best foster the development of highly effective preservice and inservice teachers.

We suggest that as educators and policymakers build models for identifying, evaluating, training, and developing effective teachers, the role played by teachers' perceptions of intelligence should be taken into consideration. Important research questions to be addressed include: (a) What part of the teacher effectiveness "equation" is explained by a teachers' implicit theories of intelligence? and (b) What ways do those implicit theories shape their in-class communications and behaviors?

Limitations

The results of this study must be interpreted within the context of the limitations. First, although this study included students from three different universities, most of the students were female and White/Caucasian. We do not know how these results might generalize to students at other universities or of other ethnicities, such as students from smaller colleges or Historically Black Colleges and Universities. Second, the inservice teacher participants in this study might not be a good representation of other inservice teachers because they were all enrolled in a university course. The fact that they were enrolled in a course might indicate a variety of things that we can only speculate about, such as that, compared to other teachers, they were more interested in improving their teaching or that they were entering teaching as a second career as a master's student. Third, we relied on an open-ended item to measure the perceptions of the students. Other measures, such as structured interviews, might allow for more in-depth explorations of students' beliefs about intelligence.

Conclusion

The purpose of this study was to investigate how preservice and inservice teachers defined intelligence, and whether they viewed it primarily as a malleable or fixed entity. We documented that preservice and inservice teachers have a variety of beliefs about what it means to be intelligent. Many participants believed that intelligence was malleable, which is a positive finding because teachers' beliefs about the malleability of intelligence have been found to affect students' beliefs about intelligence, further impacting their motivation and achievement. Yet, for the quarter of preservice and inservice teachers who believe that intelligence is a fixed trait, it would be useful to determine how their beliefs can be changed, if at all, to more malleable beliefs. It would also be useful to know whether such changes in

teachers' beliefs are accompanied by changes in their students' beliefs, motivation, and/or achievement. Future studies could also assess how preservice and inservice teachers form their beliefs about the malleability of intelligence and how teacher education courses can impact these beliefs. Finally, observations of classroom teachers could provide further insight into how teachers enact their beliefs about intelligence.

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